caseID: 1885

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Private Bag X6093, Kimberley, 8300, Tel: (053) 807 1700, Fax: (053) 832 8527
First Floor. Liberty Corner, 29-31 Curry Street, Kimberley 8301

Directorate: Mineral Regulation, Northern Cape **Date:** 14 May 2012
Enquiries: Mr.Peter Mohasoa **E-mail:** Peter.Mohasoa@dmr.gov.za
Ref: NC 30/5/1/2/3/2/1/10004 EM

The Director
South African Heritage Resources Agency
PO Box 4637
CAPE TOWN
8000

Attention: Mrs Nonofho Ndobochani

CONSULTATION IN TERMS OF SECTION 40 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT 2002, (ACT 28 OF 2002) FOR THE APPROVAL OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME REGARDING THE MINING RIGHT APPLICATION IN RESPECT OF MANGANESE ON THE PORTION OF THE REMAINDER OF THE FARM PERTH 276, SITUATED IN THE MAGISTERIAL DISTRICT OF KURUMAN, NORTHERN CAPE.

APPLICANT: SEBILO RESOURCES (PTY) LTD.

Attached herewith, please find a copy of an EMP received from the above-mentioned applicant for your comments.

It would be appreciated if you could forward any comments or requirements your Department may have to this office and to the applicant **on or before the 13th July 2012** as required by the Act.

Consultation in this regard has also been initiated with other relevant State Departments. In an attempt to expedite the consultation process please contact **Mr. Peter Mohasoa** of this office to make arrangements for a site inspection or for any other enquiries with regard to this application.

Your co-operation will be appreciated.

P. Mohasoa
.....
ACTING REGIONAL MANAGER: MINERAL REGULATION
NORTHERN CAPE REGION
DATE: 14:05:2012

SEBILO RESOURCES (PTY) LTD
MANGANESE

10 May 2012

The Regional Manager

Department of Mineral Resources

Northern Cape Region

Private Bag X609

KIMBERLEY

8300

Attention: Mr. Peter Mohasoa

Dear Sir

Re: Application for a Mining Right on the Farm Perth 276(NC/30/5/1/2/2/10004MR)

I refer to your letter dated 13 April 2012

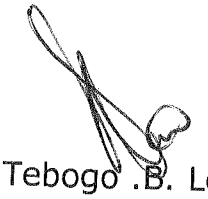
As required in terms of section 22(4) of the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002). Attached hereto find:

1. Five (5) copies Environmental Impact Assessment and Environmental Management Programme as required in terms of regulation 49 (2). Online copy will be submitted electronically.

2. This Kindly note that the correct spelling of our company name is **"Sebilo Resources (Pty) Limited"** and Not " Sibelo Resources (Pty) Limited"

Directors: T.B. Louw, A.S. Louw, A.S. Mac Farlane, D.E. Africa
121 Mendelssohn Street, Roosevelt park, 2129
Tel: 011 782 4322 / 011 782 3401

Yours Sincerely



Tebogo .B. Louw

Managing Director

SEBILO RESOURCES (PTY) LTD
MANGANESE

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1496

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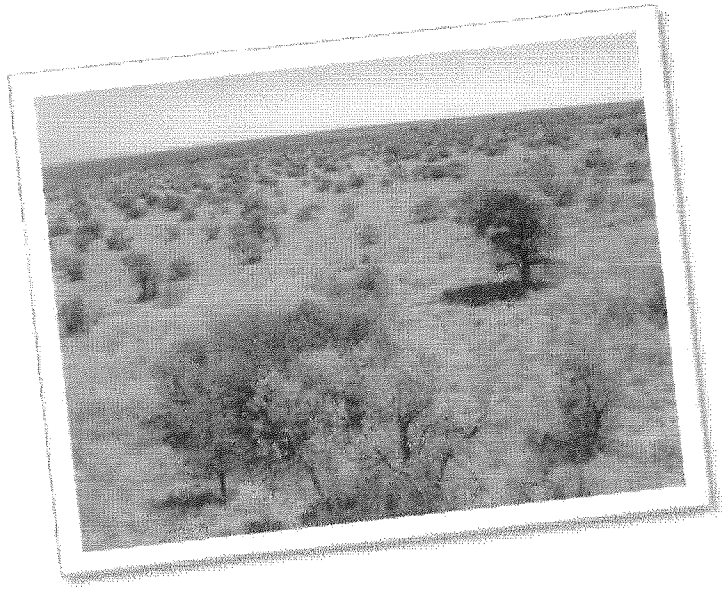
NAME OF APPLICANT: Sebilo Resources (Pty) Ltd

PROJECT: Perth Manganese Mining Right

Reference Number: NC 30/5/1/2/2/10004MR

ENVIRONMENTAL MANAGEMENT PLAN

Submitted in terms of Section 39 and Regulation 52 of the Mineral and Petroleum Resources Development Act, 2002, (Act No 28 of 2002)



iLEH
IRENE LEA ENVIRONMENTAL & HYDROGEOLOGY

Report No: iLEH-SEB PER 05-12

MAY 2012

EXECUTIVE SUMMARY

Sebilo Resources (Pty) Ltd (Sebilo) is in the process of applying for a mining right on the farm Perth 276 for manganese and associated minerals. The project is situated in the John Taolo Gaetsewe District Municipality of the Kuruman Magisterial District. The Department of Mineral Regulation (DMR) has accepted the application and requested TP Hentiq to compile an Environmental Management Plan (EMP) for the project.

The proposed mining operations will include both opencast and underground mining methods and will take place over a period of 9 – 10 years. Mining activities include opencast and underground mining, mineral processing, mine residue deposition and the transport of ore via road and possibly via rail.

The environmental requirements in the EMP comply with the Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) and its Regulations. Management plans developed also complies with other relevant legislation like the National Water Act (Act 36 of 1998). A baseline environmental assessment was undertaken to describe the environment that is likely to be affected during mining. Based on the results of the public consultation programme as well as the scoping report, a number of independent specialist consultants were appointed to complete the EIA and EMP for the mining right application. This includes soil, carrying capacity of the land, fauna and flora, surface water, groundwater, blasting, air quality, noise, visual assessment and the socio-economic setting.

A public participation programme was undertaken as part of the compilation of the EMP to identify and consult with landowners and Interested and Affected Parties (IAPs). The landowner, the Traditional Authority and other IAPs were identified by means of Title Deed searches, newspaper advertisements, site notices and through discussions at a public meeting, an open day and one-on-one discussions. Issues raised by IAPs were recorded during these interactions. All issues raised by landowners and IAPs are included in the Environmental Impact Assessment (EIA) and EMP for the mining project. The following significant impacts were identified:

- Disturbance and compaction of soil during stripping and general mining activities. Pollution of soils may occur due to spills.
- The current land use and land capability (grazing) will be lost during mining.
- 2 red data faunal species and two protected tree species may occur within the mining area.
- Surface water and groundwater may be significantly impacted on during mine dewatering. Contamination from the mining activities may also affect water resources.
- Increased noise and fugutive as well as inhalable dust levels will be created during mining.
- The project will have a high positive socio-economic impact through job creation.
- The project will unfortunately also have a high negative socio-economic impact through creation of dependency on benefits from the mining operations on local communities.

All impacts identified during the project were used to develop an Environmental Management Plan (EMP) for the project. The EMP includes a Closure and Rehabilitation Plan, an Emergency Response Plan (a Spill Procedure, Fire Management Plan and Storm Evacuation Procedure), a Complaints Handling Procedure, Rehabilitation Plan and financial provision for rehabilitation.

The project will be monitored regularly through a comprehensive monitoring programme and a bi-annual independent Performance Assessment Audits will be undertaken to determine the level of environmental compliance during mining. The results of the monitoring and audits will be submitted to the DMR. All mining personnel will receive the necessary training to implement and monitor the requirements of the EMP.

The financial provision for rehabilitation will be given in the form of a bank guarantee to the value of R12.6 million. The calculation of the rehabilitation provision presented here includes the costs for unplanned and final rehabilitation and closure.

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LIST OF ACRONYMS AND ABBREVIATIONS USED

ABA	Acid Base Accounting
ABET	Adult Basic Education and Training
AMD	Acid Mine Drainage
AP	Acid Potential
BBBEE	Broad Based Black Economic Empowered
BEE	Black Economic Empowerment
BID	Background Information Document
CR	Critically Endangered
CSI	Corporate Social Investment
DD	Data Deficient
DEM	Digital Elevation Model
DMA	District Management Area
DME	Former Department of Minerals and Energy
DMR	Department of Mineral Regulation
DWA	Department of Water Affairs
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
FEL	Front End Loader
GIS	Geographic Information System
GRAS	Generally regarded as safe
HDSA	Historically Disadvantaged South African
IAPs	Interested and Affected Parties
IDP	Integrated Development Plan
iLEH	Irene Lea Environmental and Hydrogeology cc
IRR	Internal Rate of Return
JTG DM	John Taolo Gaetsewe District Municipality
KMF	Kalahari Manganese Field
LED	Local Economic Development
LMO	Lower Manganese Ore
LOM	Life of Mine
LSU	Large Stock Unit

mamsl	metres above mean sea level
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
Mn	Manganese
MOA	Memorandum of Agreement
Mtpa	Million tonnes per annum
MPRDA	Minerals and Petroleum Resources Development Act (Act 28 of 2004)
MWA	Mphahlele Wessels & Associates
MWP	Mining Work Programme
NEMA	National Environmental Management Act (107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NNP	Net Neutralising Potential
NP	Neutralising Capacity
NPR	Neutralising Potential Ratio
NPV	Nett Present Value
NT	Near Threatened
NWA	National Water Act (Act 36 of 1998)
OSMRE	US Office of Surface Mining and Reclamation Enforcement
PCD	Pollution Control Dam
PFS	Pre-Feasibility Study
PM10	Inhalable particulate matter
PPP	Public-Private Partnerships
PPV	Peak Particle Velocity
RoM	Run of Mine
SANBI	South African National Biodiversity Index
SLP	Social and Labour Plan
SMME	Small Medium and Micro Enterprises
ToR	Terms of Reference
tpm	Tonnes per month
UIF	Unemployment Insurance Fund
UMK	United Manganese Kalahari
UMO	Upper Manganese Ore
VAC	Visual Absorption Capability
VAT	Value Added Tax
VIA	Visual Impact Assessment
VU	Vulnerable

DEFINITION OF TERMS

Activity	In terms of GN704 published in terms of the National Water Act, 1998 (Act No. 36 of 1998): a) any mining related process on the mine including the operation of washing plants, mineral processing facilities, mineral refineries and extraction plants, and b) the operation and the use of mineral loading and off-loading zones, transport facilities and mineral storage yards, whether situated at the mine or not, (i) in which any substance is stockpiled, stored, accumulated or transported for use in such process; or (ii) out of which process any residue is derived, stored, stockpiled, accumulated, dumped, disposed of or transported;
Audit	Inspection of mining activities to confirm implementation of and compliance with the EMP.
Bund	Enclosure under or around a storage facility or impacted area to contain any spillage.
Clean Water System	Includes any dam, other form of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of unpolluted water
Contractor	The principal persons or company that is appointed to undertake mining and related activities.
Dam	Includes any settling dam, slurry dam, evaporation dam, catchment or barrier dam and any other form of impoundment used for the storage of unpolluted water or water containing waste
Demarcated area	The boundary and extent of the mining area, delineated with danger tape or other suitable methods
Dirty Area	Means any area at a mine or activity which causes, has caused or is likely to cause pollution of a water resource;
Dirty Water System	Includes any dam, other form of impoundment, canal, works, pipeline, residue deposit and any other structure or facility constructed for the retention or conveyance of water containing waste.
ECO	Environmental Control Officer – the person appointed by Sebilo tasked with implementing and managing the EMP before, during and after mining.
Environmental incident	An incident, which potentially could significantly impact on the environment and that can cause irreversible damage to sensitive areas. This includes: • Spill of oil, diesel or other hydrocarbon products. • Erosion or potential damage along the access road. • Dangerous situations where livestock or people can be injured by any activity undertaken as part of mining.
Environmental Management Programme	Means an environmental management programme submitted in terms of section 39 of the Minerals Act, 1991 (Act No. 50 of 1991)
Facility	In relation to an activity, includes any installation and appurtenant works for the storage, stockpiling, disposal, handling or processing of any substance;
Manager, Mine and Mineral	Have the meanings assigned to them in the Mine Health and Safety Act, 1996 (Act No. 29 of 1996). May be the same person as the Project Manager detailed below.
Person in control of a Mine or Activity	In relation to a particular mine or activity, includes: • The owner of such mine or activity, the lessee and any other lawful occupier of the mine, activity or any part thereof; a tributer for the working of the mine, activity or any part thereof; • The holder of a mining authorisation or prospecting permit and if such authorisation or permit does not exist, the last person who worked the mine or his or her successors-in-title or the owner of such mine or activity; and if such person is not resident in or not a citizen of the Republic of South Africa, an agent or representative other than the manager of such a mine or activity must be appointed to be responsible on behalf of the person in control of such a mine or activity
Project Manager	A person who represents Sebilo who is responsible for enforcing the technical and contractual requirements of the project.
Residue	Includes any debris, discard, tailings, slimes, screenings, slurry, ultrafine material, waste rock, beneficiation plant waste, ash and any other waste product derived from or incidental to the operation of a mine or activity and which is stockpiled, stored or accumulated for potential re-use or recycling or which is disposed of
Residue Deposit	Includes any dump, ultrafines empoundment, tailings dam, slimes dam, ash dump, waste rock dump, in-pit deposit and any other heap, pile or accumulation of residue
Site Manager	A person representing Sebilo who is responsible for making sure that mining complies with the instructions of Sebilo as well as with legal requirements
Stockpile	Includes any heap, pile, slurry pond and accumulation of any substance where such substance is stored as a product or stored for use at any mine or activity.
Water System	Includes any dam, any other form of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of water

IDENTIFICATION OF THE APPLICATION IN RESPECT OF WHICH THE ENVIRONMENTAL MANAGEMENT PLAN IS SUBMITTED

ITEM	COMPANY CONTACT DETAILS
Name	Sebilo Resources (Pty) Ltd
Tel no	011 782 4322
Fax no:	011 782 3401 / 806 730 7556
Cellular no	082 497 8254
E-mail address	tebogol@intekom.co.za
Postal address	P O Box 48477, Roosevelt Park, 2129

ITEM	CONSULTANT CONTACT DETAILS
Name	Irene Lea Environmental and Hydrogeology cc (iLEH)
Tel no	011 363 2926
Fax no:	086 672 9900
Cellular no	083 447 8377
E-mail address	Irene@ileh.co.za
Postal address	P O Box 343, Dunnottar, 1590

1 THE ENVIRONMENT LIKELY TO BE AFFECTED

Undertaken in terms of Regulation 52(2) of the MPRDA and compiled according to the DMR Guideline for the Compilation of an Environmental Management Plan.

1.1 The environment on site relative to the surrounding area

1.1.1 Setting

The proposed Sebilo Perth Mining Operation is situated on the remaining extent of the farm Perth 276, in the John Taolo Gaetsewe District Municipality (JTG DM) (previously known as the Kalagadi District Municipality), in the Northern Cape Province about 10 km south of the mining town of Hotazel. The regional location of the project is shown in Figure 1. The project is situated 50 km north of Kathu and 50 km west of Kuruman. Before 2011 the Perth Project area was under the administration of the District Municipal Authority and from 2012 the area will be re-demarcated and transferred to the jurisdiction of the Joe Morolong Local Municipality (previously called the Moshaweng Local Municipality).

Main and secondary roads within the area include:

- The R31 is the main route in the area and enters the project area from the southeast and stretches in a north western direction towards the Kgalagadi Transfrontier Park (Kalahari Gemsbok National Park).
- The R380 enters the project area from N14 national road in the south and stretches in a northern direction. It links up with the R31 in the north.
- The Transnet Freight Rail railway line runs parallel to the R380 and starts at Black Rock and runs south past the project area. The railway line is used to transport manganese ore to Port Elizabeth.

A Prospecting Right (MPT 240/2009) issued on the remaining extent of the farm Perth 276 in the Kuruman District was transferred according to section 11 of the MPRDA from Assmang Limited to Seblio Resources (Pty) Ltd during 2009. Sebilo completed the prospecting programme on the farm during 2010/2011 and compiled a pre-feasibility study to develop a mine on the project. Sebilo is currently in the process of applying for a Mining Right on the farm. The Department of Mineral Resources (DMR) accepted Sebilo's application for a Mining Right on 11 November 2011 (Reference no NC 30/5/1/2/2/10004MR).

If the mining right is granted, Sebilo plans to extract manganese ore using both opencast and underground mining methods. At the start of the operations, only opencast mining will be conducted. Underground mining is expected to commence in 2023. Mining is expected to cease during 2026.

1.1.2 Climate

The project area falls within the summer rainfall region of South Africa, in which more than 80% of the annual rainfall occurs between October and April. Some 85% of the rainfall falls during summer. The average annual precipitation is 334 mm/a and the annual average evaporation rates are in the order of 2070 mm/a, as detailed in Section 1.1.7.

Temperatures in this climate zone are generally moderate to high, although low minima can be experienced during the winter months due to clear night skies. Temperature can vary between 38 and 0 °C in summer and 30 and -5 °C in winter. The annual prevailing wind direction during the day for summer and winter months is from the south.

1.1.3 Topography

The site topography is best described as being relatively flat with little topographical features, other than those associated with the historical mining activities (see Figure 3). Locally, the natural topography dips slightly in a south-westerly direction towards the stream bed of the non-perennial Witleegte drainage line.

The topographical elevation within the proposed mining area, is between 1031 and 1087 metres above mean sea level (mamsl). The higher lying areas are associated with the historical waste rock dump in the southern corner of the project and the old manganese ore floor situated along the north-eastern edge of the project along the road. Low-lying areas are found along the south-western along the boundary between the farms Perth 276 and Botha 313. The low-lying area that runs along this boundary forms the Witleegte drainage line, as shown in Figure 3. The Witleegte drainage line consists of a dry, concave channel, 75 – 150m wide, with a 0.5% slope in the flow direction and 1 – 10% slopes on the edges.

The natural topographical gradient on site is approximately 1:60 to 1:70.

Apart from the disturbed old mining area and the drainage line, the remainder of the mining right area is dominated by gently undulating dunes.

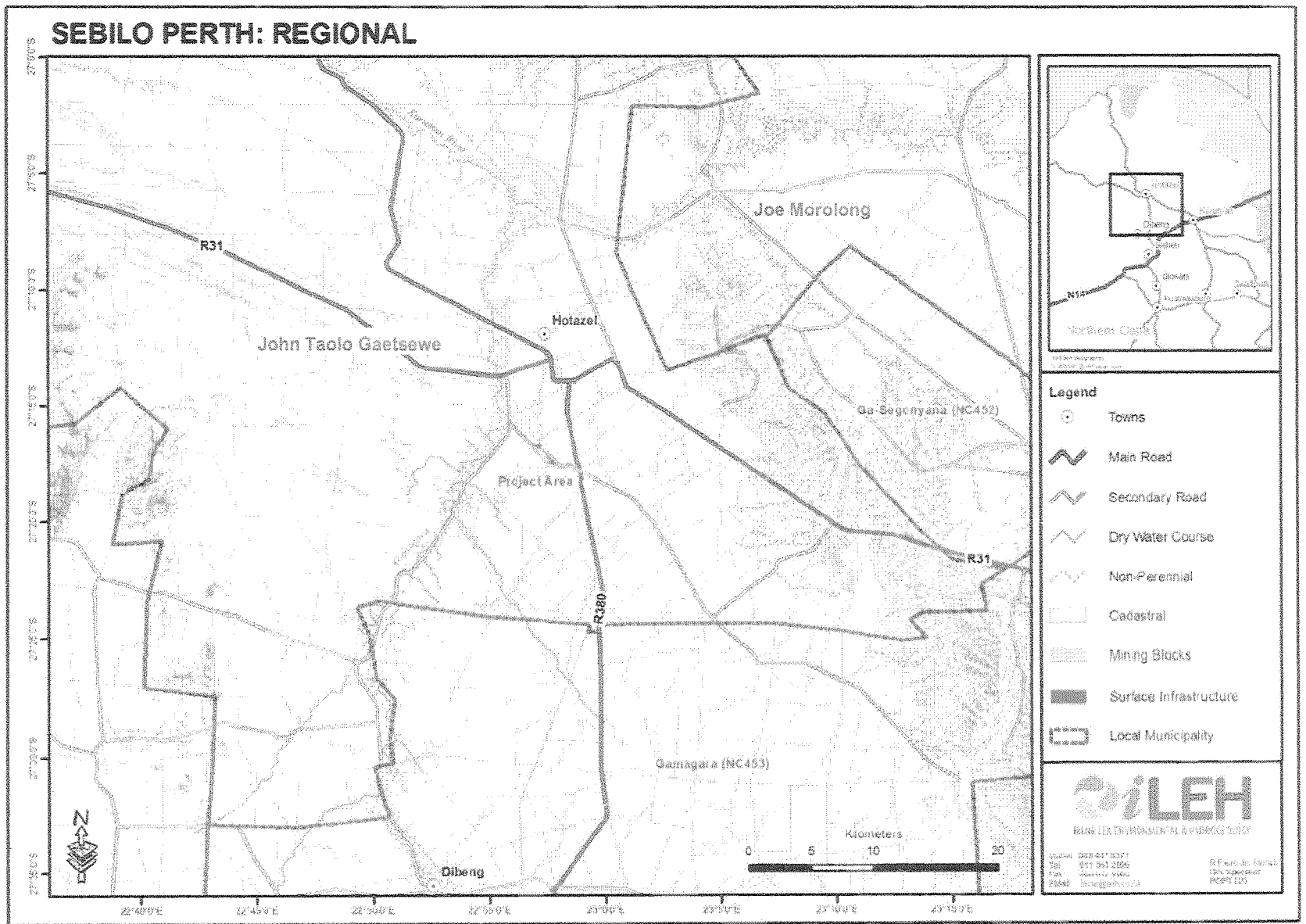


Figure 1 Regional setting

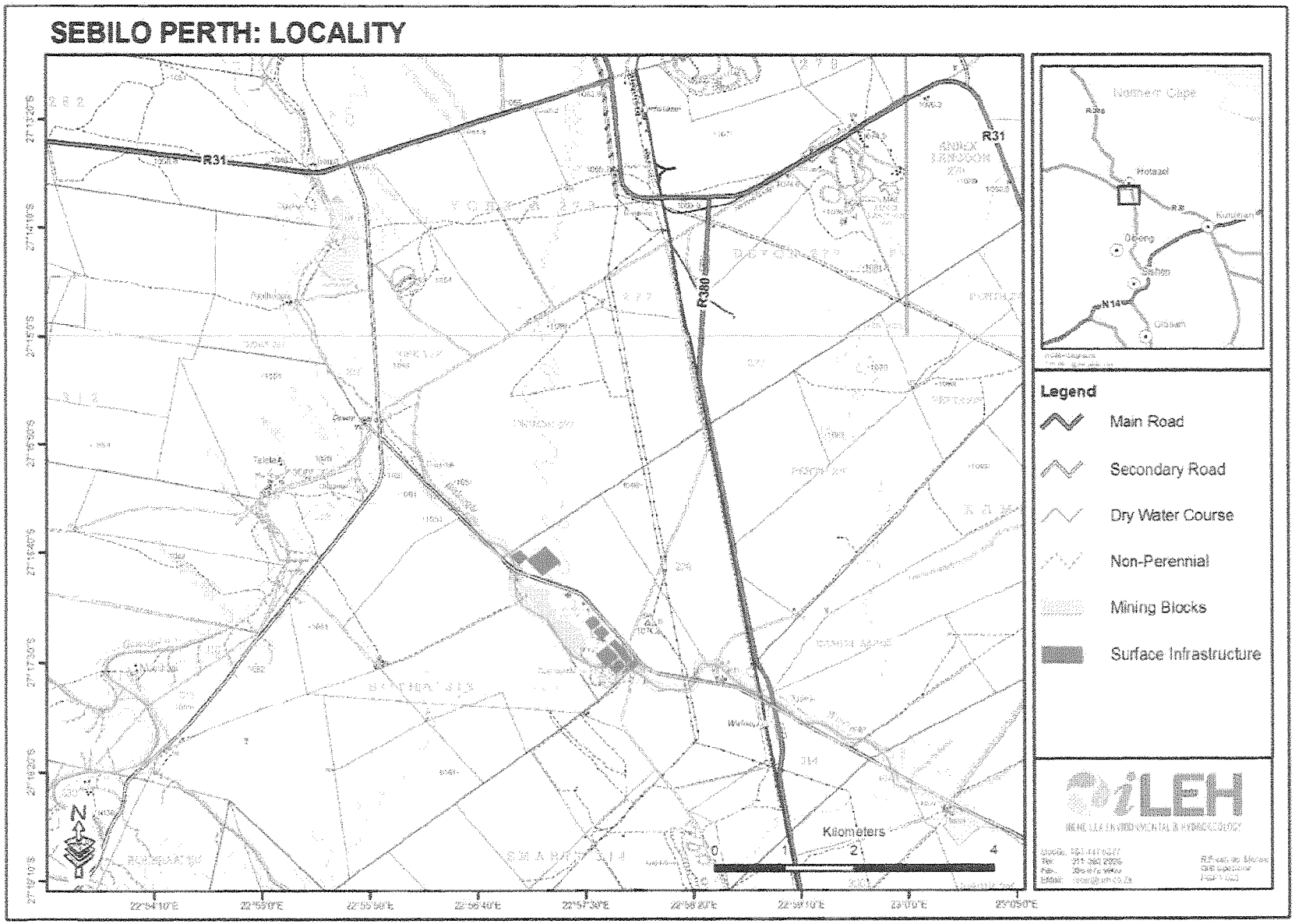


Figure 2 Local setting

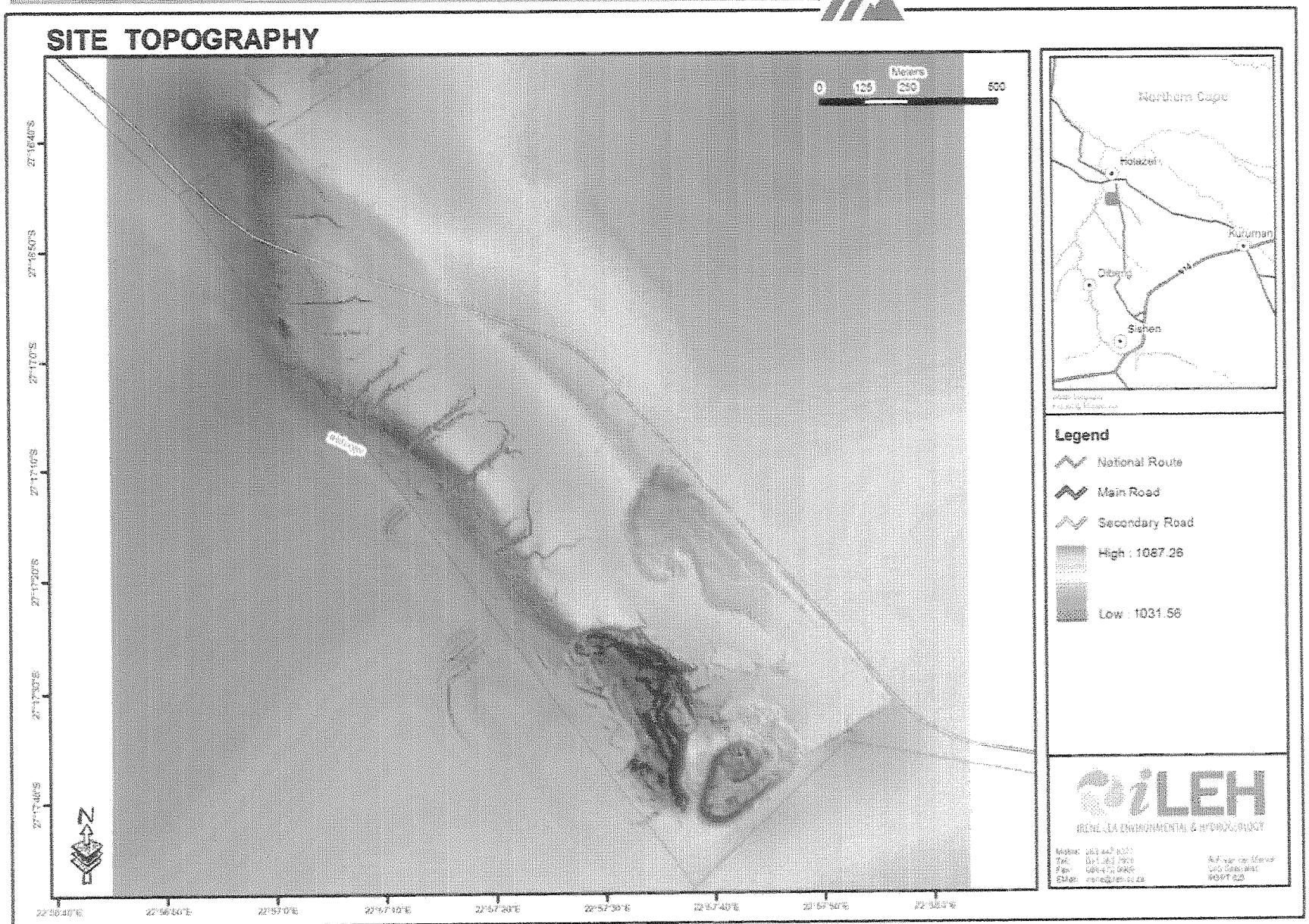


Figure 3 Site topographical layout

1.1.4 Soil, land use and land capability

Rehab Green Monitoring Consultants cc (Rehab Green, 2012) completed the soil specialist study for the project over the total mining right application area, as shown in Figure 4. This includes the existing old open pit (9.14 ha), the proposed new pit (23.6 ha),the footprint of the existing waste rock dump (overburden material) and the riparian zone and the Witleegte drainage line. The 100m riparian buffer zone is indicated as a dotted blue line on Figure 4. The proposed mining infrastructure is also indicated on Figure 4. It is noted that some of the future infrastructure is situated within the footprint of the current waste rock dump. The waste rock will be moved during the construction phase of the project to create space for the proposed infrastructure. Waste rock moved as part of this process will be backfilled into the existing pit.

A full copy of the specialist report is contained in Appendix 1. The results of this study are incorporated into the Perth Environmental Management Plan (EMP), as detailed below.

1.1.4.1 Soil classification

The soils were investigated by means of auger holes to a depth of 2400mm or to the depth of refusal on a 150 x 150m pre-determined grid. Soils were described and classified according to the South African Taxonomic Soil Classification System (Soil Classification Working Group, 2nd Edition, 1991). A total of 54 auger observations were made to delineate the riparian zone. The system of soil classification as well as the soil properties that were used in the soil classification is discussed in more detail in Appendix 1.

The A and B, E or G-horizons (0-250mm and 300-700mm) of the dominant soil types were sampled and analysed at the Institute for Soil, Climate and Water, including soil acidity, extractable cations and phosphorus status.

A total of 3 soil types, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations and were symbolised as: **Hu**, **Hu-D** and **Ad**. The localities and extent of the soil types are shown on the soil map, Figure 5.

Two non-soil related units were also included in the soil legend and are symbolized as **OB-Cal** and **OP**. Unit **OB-Cal** comprises the area covered mainly with waste rock (overburden) material, which was historically removed from the existing open pit. The thickness of waste rock varies from 1 to approximately 20m and the soils below could therefore not be assessed. Unit **OP** comprises the footprint of the old open pit where all topsoil was removed. The localities of the 54 auger observation points are shown on the soil map (Figure 5) as yellow and red dots. Auger observations shown as red dots were sampled and chemically analysed. The soil types are summarised on Figure 5 and detailed in Table 1 in terms of the following aspects:

- Dominant and subdominant soil forms and families;
- Average effective soil depth;
- The estimated clay content of the A and B or E or G-horizons;
- The derived texture class;
- A description of the terrain unit and slope, a broad description of the dominant soil form;
- A description of the soil horizon sequences;
- The soil derived land capability and wetland zone classification; and
- The area and percentage comprised by each soil type.

Table 1 Dominant and sub-dominant soil form and family

Soil Type Code	Dominant & subdominant Soil Form and Family	Effective Soil Depth (mm)	% Clay per horizon	Texture Class	Terrain and slope	Summarized description of the dominant soil type	Summarized description of soil horizons sequences	Agricultural Potential	Land Capability	Erodibility	Area (ha)	Area (%)
Hu	*Hutton 3100	>2400	A: 4-8 B1: 4-8	Sand	Gently undulating sand dunes (3-6% slopes) with occasional fairly flat crests and footslopes (1-2% slopes).	Very deep (> 2400 mm), red, well-drained, aeolian sand (wind transported sand)	A red, sandy Orthic A-horizon (0-250 mm), overlying a red, sandy B1-horizon (250-2400+ mm).	Low	Grazing	Low	99.34	62.23
Hu-D	*Hutton 3100	>2400	A: 4-8 B1: 4-8	Sand	Fairly flat footslope (1-3% slope) within old mining area, covered with a thin layer of gravel rock material	Very deep (> 2400 mm), red, well-drained, aeolian sand (wind transported sand) covered with gravel rock fragments during previous mining operation.	100-400 mm gravel rock overburden, overlying a red, sandy Orthic A-horizon (0-250 mm), overlying a red, well-drained, sandy B1-horizon (250-2400+ mm).	Low	Grazing	Low	11.18	7.0
Ad	*Addo 2111 Prieska 2110	1000-1500+	A: 4-8 B1: 4-8	Sand	Dry, concave drainage line, 75-150m wide, 0.5% slope in flow direction and 1-10% slopes on edges.	Deep, (1000-1500+ mm), pale yellow, well-drained, calcareous sandy soils in a natural drainage line, underlain by soft or hard carbonate.	A pale, yellowish brown, sandy Orthic A-horizon (0-250), overlying a pale brownish yellow, calcareous, sandy Neocarbonate B1-horizon (250-1000+), overlying a soft or hard carbonate B2-horizon.	Very low	Riparian zone	Moderate-high	12.64	7.92
OB-Cal	*Hutton 3100 (not assessed)	-	-	-	Overburden dump, approximately 1-6 m high consisting mainly of calcrete rock material.	Soils below the overburden dump could not be assessed but are probably deep, red sandy soils similar to soil type Hu.	Soils below the overburden dump could not be assessed but are probably deep, red sandy soils similar to soil type Hu.	None	Wilderness	-	27.33	17.12
OP	-	0	-	-	Old open pit with vertical high wall to the west, approximately 15-20 m deep. Partly filled with water.	No soil	No soil	None	Wilderness	-	9.14	5.73
										TOTAL	159.63	100.0

* Dominant soil form and family

The soil qualities derived from the soil properties for each soil type are summarised in Table 2. The soil qualities were rated as high, moderate and low with classification in-between these.

Table 2 Derived soil properties

Soil Type (Code)	Current fertility Status	Dry land crop production potential	Irrigation potential
Hu	Moderate-low	Very low	Very low
Hu-D	Moderate	Very low	Very low
Ad	Moderate-high	Very low	Very low
OB-Cal	Not assessed	Very low	Very low
OP	No soil	None	None

1.1.4.2 Soil Chemistry

The soil analytical results of representative samples collected from the A-horizon (0-200 mm) and B-horizon (300-700 mm) are shown in Table 3. Results of undisturbed red sandy soils are highlighted in green and results of soils in the riparian zone and disturbed mining area are highlighted in blue and orange respectively. The positions of the sampling points are shown in Figure 5 and coordinates are included in Appendix 1.

The averages of base cations [potassium (K), calcium (Ca) magnesium (Mg) and sodium (Na)] as well as phosphorus and pH were calculated for both undisturbed and disturbed areas and highlighted in yellow and pink respectively.

Table 3 Soil chemical analyses

Samp Point	Soil Form	Hor	Depth	K	Ca	Mg	Na	*Titr.Acid	*Acid saturat.	Resis-tance	P (Bray1)	pH (H_2O)
				mg/kg	mg/kg	mg/kg	mg/kg				mg/kg	
				Ammonium acetate				cmol(+)/kg	%	ohm		
Undisturbed, red, well-drained sandy soils												
I7	Hu3100	A	0-200	49	232	81	0.62	-	-	2100	3.1	5.94
		B	300-700	52	201	105	0.31	-	-	4820	1.2	6.76
K4	Hu3100	A	0-200	31	371	60	0.36	-	-	2320	2.2	7.41
		B	300-700	34	303	68	0.28	-	-	4860	1.3	7.74
L7	Hu3100	A	0-200	48	159	34	0.34	-	-	7030	1.6	7.18
		B	300-700	61	133	22	0.24	-	-	10540	1.2	7.18
O4	Hu3100	A	0-200	128	185	74	2.2	-	-	3080	1.6	6.96
		B	300-700	68	235	113	6.7	-	-	2560	1.3	7.06
Average (undisturbed)				**59**	**227**	**70**	**1.4**				**1.7**	**7.03**
Soils in riparian zone												
41	Ad2111	A	0-200	127	3251	194	0.26	-	-	2020	3.2	8.72
		B	300-700	172	3509	431	111.6	-	-	180	3.1	8.16
Soils in disturbed mining area												
F9	Hu3100	A	0-200	35	573	334	5.5	-	-	2620	1.8	8.7
		B	300-700	52	507	299	10.3	-	-	2490	1.4	8.54
Average (disturbed)				**44**	**540**	**317**	**7.9**				**1.6**	**8.62**

*Analysis conducted when pH is below 5.5

1.1.4.3 Soil fertility status

The averages of the base cations (K, Ca, Mg, Na) as well as phosphorus and pH of the **undisturbed soils** (highlighted in yellow, Table 3) were compared to general fertility guidelines (Fertilizer Association of South Africa, 2003) in Table 4.

Table 4 Soil fertility compared to broad fertility guidelines

Guidelines (mg/kg)						Average calculated from Table 3 (mg/kg)	Status
	Low		High				
Potassium (K)	<40		>250			59	Moderate-low
Calcium (Ca)	<200		>3000			227	Moderate-low
Magnesium (Mg)	<50		>300			70	Moderate-low
Sodium (Na)	<50		>200			1.4	Low, which is positive
Phosphorus (P)	<5		>35			1.7	Low
pH(H_2O)							
Very acid	Acid	Slightly acid	Neutral	Slightly alkaline	Alkaline		
<4	5-5.9	6-6.7	6.8-7.2	7.3-8	>8	7.03	Neutral

The averages of base cations (K, Ca and Mg) are moderate to low. The average sodium (Na) content of 1.4 mg/kg is low, which is positive and indicates an absence on sodic soil conditions. The average pH value of 7.03 indicates neutral soil conditions and is within the optimal range of 6.8-7.2. The average phosphorus content of 1.7 mg/kg is very low but is normal for unfertilized sandy soils.

The averages of the base cations of soils in the riparian zone (highlighted in blue in Table 3) are somewhat to substantial higher, which indicates an accumulation of salts in the lower lying landscape. The average pH value of 8.4 indicates alkaline soil conditions. The low phosphorus content in the A and B-horizon reflects normal concentrations in unfertilized sandy soils.

1.1.4.4 Land capability assessment

Land capability was assessed according to the definitions outlined in the guidelines for rehabilitation of mined land (Chamber of Mines and Coaltech Research Association, 2007). According to these guidelines, the soil types are classified according to the following categories:

- Arable potential
  - Well drained soils,
  - Moderately well-drained soils;
- Grazing potential
  - Well drained soils,
  - Moderately well-drained soils;
- Wetland and riparian zones
  - Imperfectly drained soils,
  - Somewhat poorly to poorly drained soils; or
  - Well-drained (riparian zones)
- Wilderness
  - Rocky areas.
  - Disturbed areas

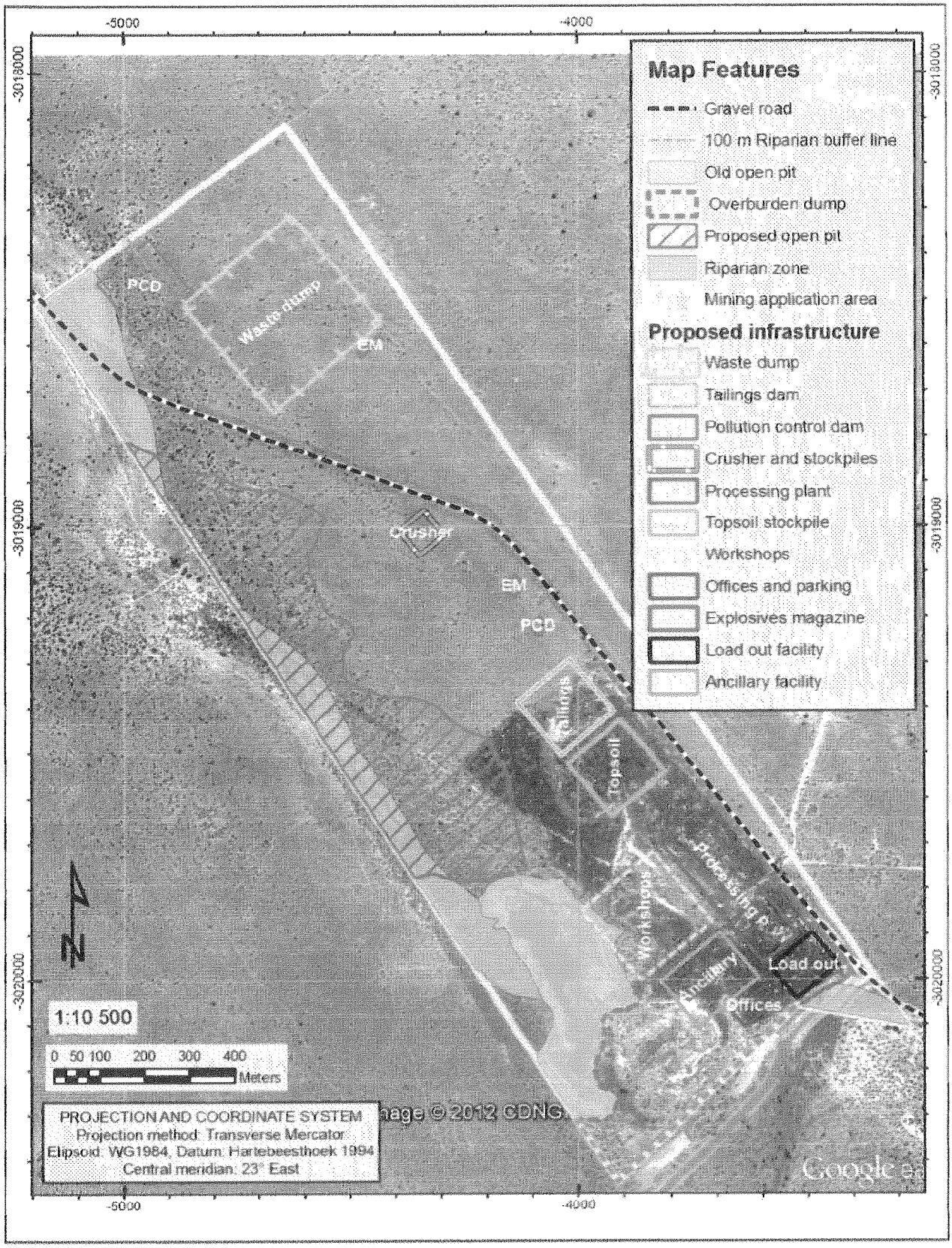
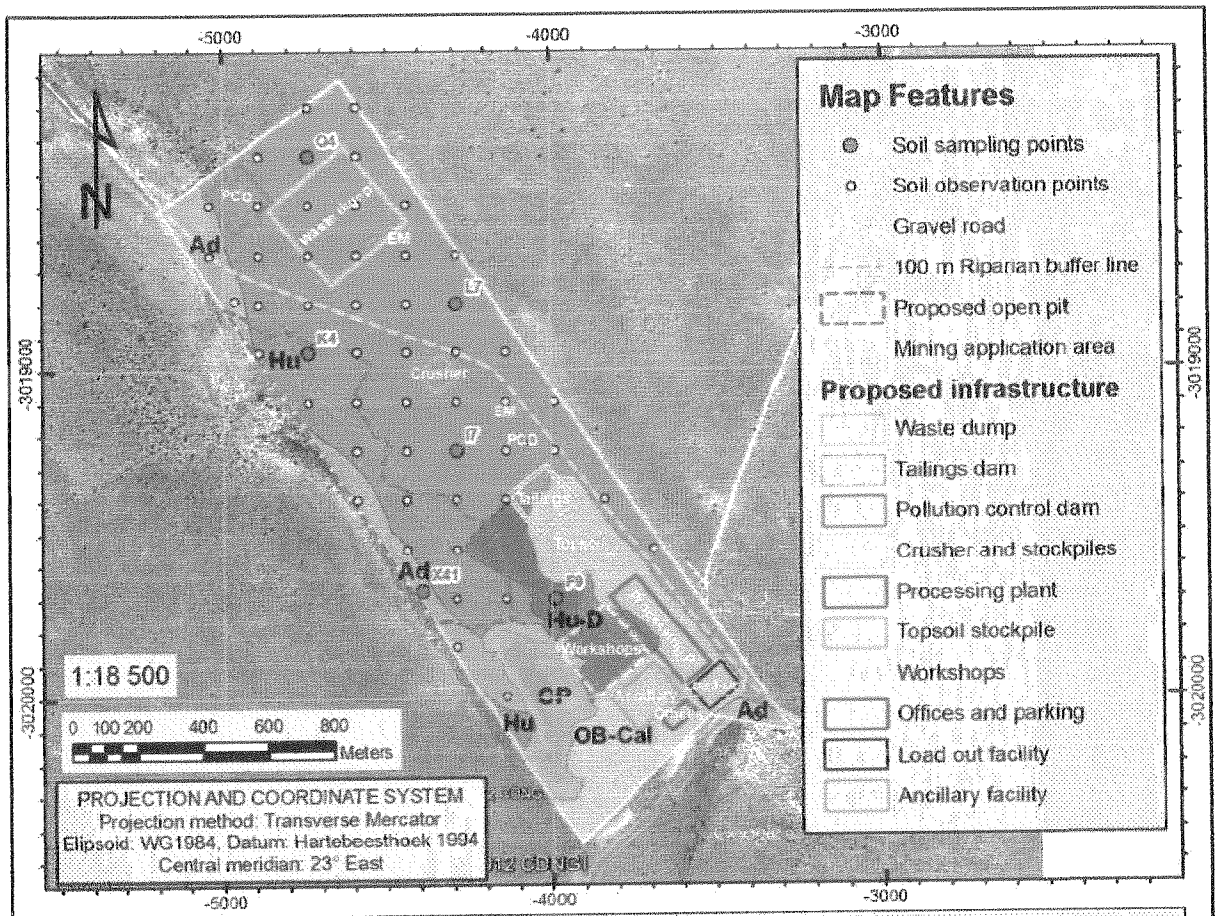


Figure 4 Soils - infrastructure and key components



SOIL LEGEND (Abbreviated soil legend, for full legend refer to the soil report)

Soil Type Code	Dominant & subdominant Soil Form and Family	Terrain unit and slope	Summarized description of terrain and soil type	Summarized description of soil horizons sequences	Land Capability	Area (ha)	Area (%)
Hu	*Hutton 3100	Gently undulating sand dunes (3-6% slopes) with occasional fairly flat crests and footslopes (1-2% slopes).	Very deep (> 2400 mm), red, well-drained, aeolian sand (wind transported sand)	A red, sandy Orthic A-horizon (0-250 mm), overlying a red, sandy B1-horizon (250-2400+ mm).	Grazing	99.34	62.23
Hu-D	*Hutton 3100	Fairly flat footslope (1-3% slope) within old mining area, covered with a thin layer of gravel rock material	Very deep (> 2400 mm), red, well-drained, aeolian sand (wind transported sand) covered with gravel rock fragments during previous mining operation.	100-400 mm gravel rock overburden, overlying a red, sandy Orthic A-horizon (0-250 mm), overlying a red, well-drained, sandy B1-horizon (250-2400+ mm).	Grazing	11.18	7.0
Ad	*Addo 2111 Prieska 2110	Dry, concave drainage line, 75-150m wide, 0.5% slope in flow direction and 1-10% slopes on edges.	Deep, (1000-1500+ mm), pale yellow, well-drained, calcareous sandy soils in a natural drainage line, underlain by soft or hard carbonate.	A pale, yellowish brown, sandy Orthic A-horizon (0-250), overlying a pale brownish yellow, calcareous, sandy Neocarbonate B1-horizon (250-1000+), overlying a soft or hard carbonate B2-horizon.	Riparian zone	12.64	7.92
OB-Cal	*Hutton 3100 (not assessed)	Overburden dump, approximately 1-6 m high consisting mainly of calcrete rock material.	Soils below the overburden dump could not be assessed but are probably deep, red sandy soils similar to soil type Hu.	Soils below the overburden dump could not be assessed but are probably deep, red sandy soils similar to soil type Hu.	Wilderness	27.33	17.12
CP		Old open pit with vertical high wall to the west, approximately 15-20 m deep. Partly filled with water.	No soil	No soil	Wilderness	9.14	5.73
					Total	159.63	100.0

* Dominant soil form and family

Figure 5 Detailed soil map

Table 5 and Figure 6 show the land capability classes and associated soil types, which were grouped into each land capability class, a broad description of the soil type, the agricultural potential, and the area and percentage comprised by individual soil types within each land capability class as well as the total per land capability class.

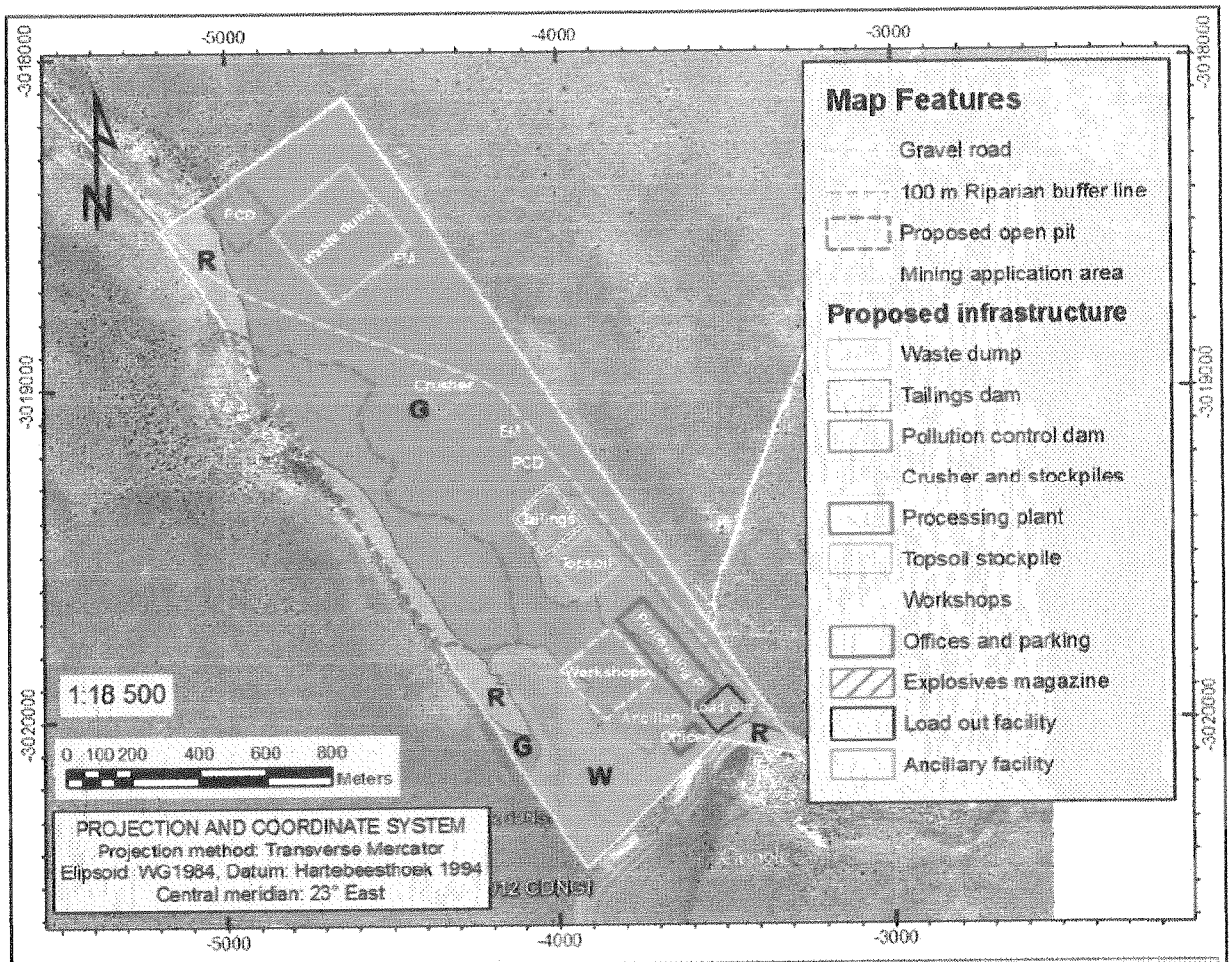
Table 5 Land capability classes, soils and agricultural potential

Land Capability (Code)	Internal drainage	*Soil type code	Broad soil description	Agricultural potential	Area (ha)	Area (%)	Area per class (ha)	Area per class (%)
Arable (A)	Well-drained	No soils in this category			0	0	0	0
	Moderately well-drained	No soils in this category			0	0		
Grazing (G)	Well-drained	Hu	Very deep (> 2400 mm), red, aeolian sand (wind transported sand)	Low	99.34	62.23	110.52	69.23
		Hu-D	Very deep (> 2400 mm), red, well-drained, aeolian sand covered with a thin layer of gravel rock fragments from previous mining operation.	Low	11.18	7.0		
	Moderately well-drained	No soils in this category			0	0		
Riparian (R)	Well-drained	Ad	Deep, (1000-1500+ mm), pale yellow, calcareous sandy soils in a natural drainage line, underlain by soft or hard carbonate.	Very low	12.64	7.92	12.64	7.92
	Somewhat poorly to poorly	No soils in this category			0	0		
Wilderness (W)	Dumps	OB-Cal	Overburden dump, approximately 1-6 m high consisting mainly of calcrete rock material.	None	27.33	17.12	36.47	22.85
	Open pits	OP	Old open pit with vertical high wall to the west, approximately 15-20 m deep. Partly filled with water.	None	9.14	5.73		
*See soil map (Figure 5)		Total			159.63	100.0	159.63	100.0

1.1.4.5 Agricultural potential classification

The classification of agricultural potential of soils was based on soil properties noted during auger observations, including effective soil depth, texture, terrain unit, slope, soil wetness and disturbances. The effective soil depth is the main soil characteristic that determines the agricultural potential. The agricultural potential classification criteria of the soils are:

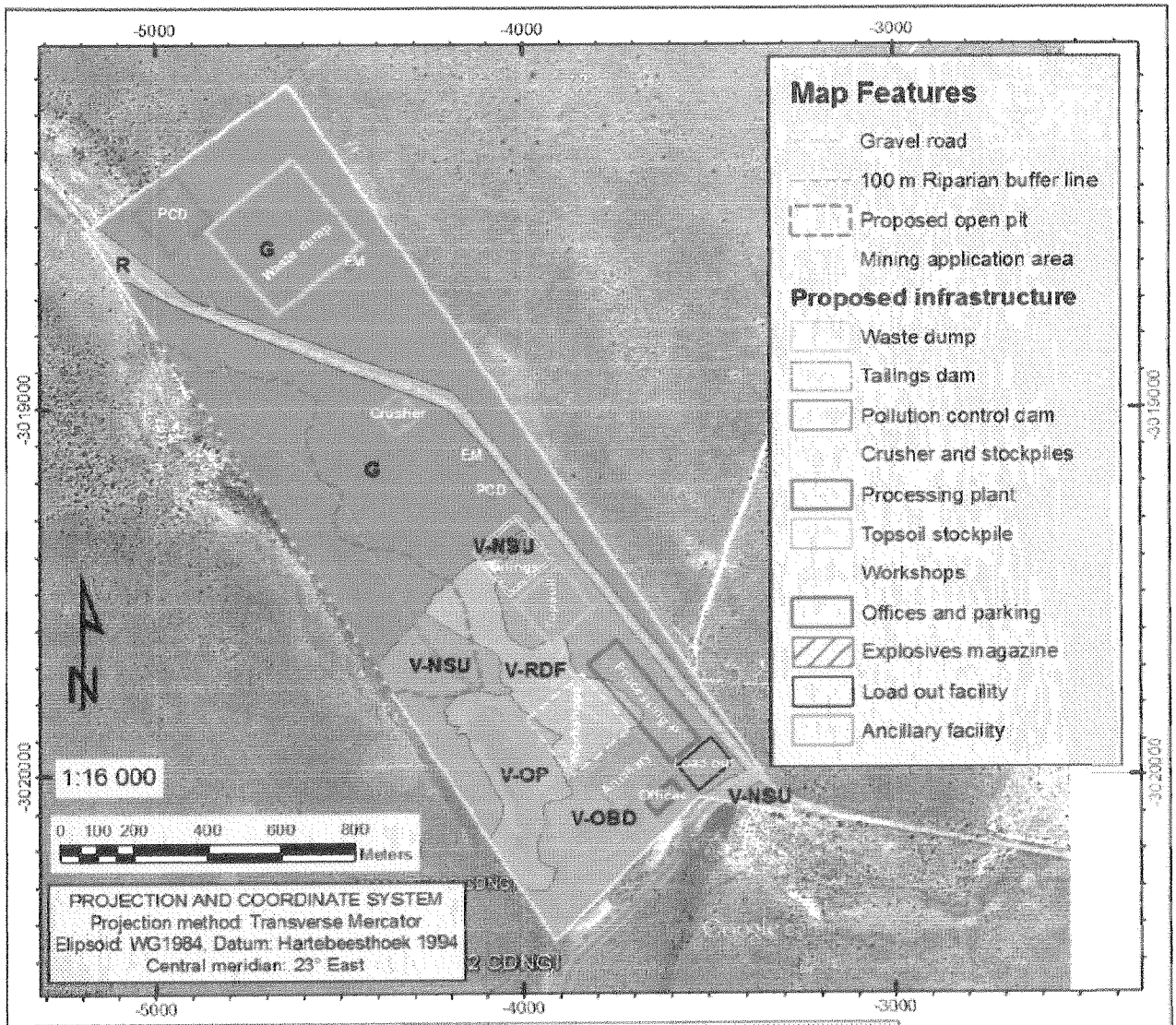
- **High** – well-drained and moderately well-drained soils with an effective depth deeper than 900mm.
- **Moderate** - well-drained and moderately well-drained soils with an effective depth of 600-900mm.
- **Low** - well-drained and moderately well-drained soils with an effective depth less than 600mm or leached, grey, sandy soils showing evidence of periodic percolating water tables, or black and grey clay soils showing evidence of poor internal drainage or very sandy soils in low rainfall areas.



LEGEND: LAND CAPABILITY

Land Capability (Code)	Internal drainage	*Soil type code	Broad soil description	Agricultural potential	Area (ha)	Area (%)	Area per class (ha)	Area per class (%)
Arable (A)	Well-drained	No soils in this category			0	0	0	0
	Moderately well-drained	No soils in this category			0	0		
Grazing (G)	Well-drained	Hu	Very deep (> 2400 mm), red, aeolian sand (only true sported sand)	Low	99.34	62.23	110.52	69.23
		Hu-D	Very deep (> 2400 mm), red, well-drained, aeolian sand covered with a thin layer of gravel rock fragments from previous mining operation	Low	11.18	7.0		
	Moderately well-drained	No soils in this category			0	0		
Riparian (R)	Well-drained	Ad	Deep, (1000-1500+ mm), pale yellow, calcareous sandy soils in a natural drainage line, underlain by soft or hard carbonate	Very low	12.64	7.92	12.64	7.92
	Somewhat poorly to poorly	No soils in this category			0	0		
Wilderness (W)	Dumps	OB-Ca	Overburden dump, approximately 1.8 m high consisting mainly of calcrete rock material	None	27.33	17.12	36.47	22.85
	Open pits	OP	Old open pit with vertical high wall to the west, approximately 15-30 m deep. Partly filled with water	None	9.14	5.73		
*See Figure 5				Total	159.63	100.0	159.63	100.0

Figure 6 Land capability map



LEGEND – PRE-MINING LAND USE					
Land Use Code	Pre-mining Land Use		Unit Count	Area (ha)	Area (%)
G	Natural grazing – mainly used for cattle		2	91.54	57.35
R	Gravel road and fenced off edges		1	9.93	6.22
V-OP	Vacant: Fenced-off old mining area, currently abandoned.	Old open pit	1	9.14	5.73
V-OBD		Overburden dump, consisting mainly of calcrete	1	27.77	17.4
V-RDF		Old rock dump footprint, surface covered with a thin layer of fractured rock	1	11.18	7.00
V-NSU		Undisturbed – no specific use	3	10.07	6.32
		TOTAL	9	159.63	100.0

Figure 7 Pre-mining land use

1.1.4.6 Pre-mining land use

The current land uses within the mining application area are summarized in Table 6 and the localities and extents are shown in Figure 7.

Table 6 Pre-mining land uses

Land Use Code	Pre-mining Land Use		Unit Count	Area (ha)	Area (%)
G	Natural grazing – mainly used for cattle		2	91.54	57.35
R	Gravel road and fenced off edges		1	9.93	6.22
V-OP	Vacant: Fenced-off old mining area, currently abandoned.	Old open pit	1	9.14	5.73
V-OBD		Overburden dump, consisting mainly of calcrete	1	27.77	17.4
V-RDF		Old rock dump footprint, surface covered with a thin layer of fractured rock or ore	1	11.18	7.00
V-NSU		Undisturbed – no specific use	3	10.07	6.32
TOTAL			9	159.63	100.02

1.1.4.7 Wetland and riparian delineation

Wetland and riparian zones are delineated according to the practical field procedure for the identification and delineation of wetlands and riparian areas (Department of Water Affair and Forestry, 2005). Four indicators were used in the study to delineate wetland and riparian zones, namely:

- Terrain unit;
- Soil form;
- Soil wetness; and
- Wetland and riparian vegetation.

Auger observations are made systematically in transects towards the riparian zone at 50m intervals in order to locate the point from where clear evidence of wetness occurs within 500mm from surface. Further details on the delineation of wetland areas are included in Appendix 1.

Land capability was assessed in categories of arable land, grazing land, **wetland and riparian zones** and wilderness land. Wetland and riparian zones were therefore delineated as part of the land capability assessment based on soil properties by means of systematic auger observations towards the wetland or riparian zone in order to locate the point where soil properties reflect signs of wetness within 500 mm from the surface or where soil, topography and vegetation combined, indicate the boundary of the riparian zone.

The soil types associated with the riparian zone are summarized in Table 5 and the locality and extent and are shown on the land capability map Figure 6. A 100 m riparian buffer zone is indicated with a blue dotted line. (See Appendix 1 for details on soil properties related to wetland zones).

1.1.4.8 Erodibility evaluation

Erodiblity was broadly assessed based on soil texture, slope and the inherent stability of the parent rock (geology) from which the soil originated.

- **Low:** Soils with stable physical and chemical properties, which occur on flat to gentle slopes to ensure low erosion susceptibility in the natural state. Few erosion protection measures are necessary.
- **Moderate:** Soils with low to moderately unstable physical or chemical properties or soils occurring on moderate to steep slopes. Sheet and rill erosion often occur in the natural state but may become severe when these soils are disturbed or due to any misuse such as overgrazing. Erosion protection measures are necessary.
- **High:** Soils with unstable physical and chemical properties or soils occurring on very steep slopes. Rill and donga erosion often occur in the natural state and will become severe during any disturbance or misuse. Specialised erosion protection measures are necessary.

1.1.4.9 Evidence of misuse

The historical mining site, which is not currently rehabilitated, poses a health and safety risk to humans and animals.

1.1.5 Land carrying capacity

Due to the fact that the landowner uses the project area for cattle farming, a carrying capacity specialist study was undertaken for the project by Umfaan Ecological Consultants (Umfaan, 2012). The specialist report is contained in Appendix 2.

The vegetation surveys undertaken as part of this study, was done using a Bridge Point apparatus with ten pegs (see Appendix 2) on plots distributed at intervals of 20 – 30m. During the survey, in tact vegetation nearest to a peg, but within a 5cm radius is noted to determine frequency of occurrence of species. When there is no in tact vegetation within a 5cm radius, it is recorded as "bare ground". When a peg hits a tuft, it is recorded as a hit to determine basal cover. Crown cover (an area covered by above ground material like leaves and inflorescences), is an estimated value recorded at each plot.

1.1.5.1 Veld condition rating

The carrying capacity of all the areas was determined by applying a method developed by Esterhuizen et al (1997). The veld condition rating and carrying capacity of an area is determined by several factors including:

- Vegetation of the specific area, taking into consideration:
    - A - Botanical composition (0 – 10) (Species, Palatability, production)
    - B - Plant cover and perennial status (0 – 10) (Density, basal cover etc.)
    - C - Vitality of the vegetation (0 – 10)
    - D - Insect and rodent damage (0 – 10)
- Climatic conditions (long term average annual rainfall as well as rainfall of the specific season)

Veld condition rating (V) is calculated by applying the following formula:

$V = (A \times 0.75) + (B \times 0.1) + (C \times 0.1) + (D \times 0.05)$

After the veld condition rating is determined, the table attached in Appendix 2 is used to determine the carrying capacity of the area.

It is noted for the purpose of the calculations that rainfall for the area is erratic. Information obtained from the Department of Agriculture in the Northern Cape indicated that the average long term rainfall for the area is ± 340 – 350mm per annum. Rainfall figures obtained from Black Rock mine indicated that the rainfall for the 2010/11 season (November 2010 – June 2011), was 545mm. This is more than 200mm above average. The Black Rock information indicate that rainfall for part of the 2011/12 season (November 2011 – March 2012) was only 193.5mm, which is 45% below the average. It must however be taken into consideration that this rainy season is not completed.

Rainfall figures received from the UMK mine adjacent to the Perth project, indicated that the rainfall for a part of the 2010/11 season (January – June 2011) was 342 mm, which is close to the average, whilst figures for the 2011/12 season (November 2011 – March 2012) was only 150mm (57% below average).

Based on the variable rainfall, it is noted that the carrying capacity of an area is not an exact figure and will change because grazing practices as well as varying climatic conditions can change the parameters evaluated and discussed below.

1.1.5.2 Carrying capacity vegetation assessment

The vegetation of the area classified Musina and Rutherford (2006) as Veld type SVk 12 (Kathu Bushveld). The most important trees indicated are *Acacia erioloba*, *Acacia mellifera* subsp. *detinens, Terminalia sericea and Boscia albitrunca*. Grass species includes *Aristida meridionalis, Brachiaria nigropedata, Eragrostis lehmanniana, Stipagrostis ciliata, Schmidtia pappophoroides, Stipagrostis uniplumis, Aristida congesta, Eragrostis pallens,* and *Melinis repens.* During the survey most of these species were identified. Important species identified and not included in the list of Musina and Rutherford (2006) are the following:

Trees: *Acacia haematoxylon* and *Ziziphus mucronata*

Shrubs: Grewia flava

Grasses: *Aristida stipitata*

Although clumps as well as individual plants of *Acacia mellifera* subsp. *detinens* are present, some of the plants were eradicated chemically (herbicides) by the farmer. Only a few large specimens of *Acacia erioloba* and *Terminalia sericea* could be identified while the majority of the woody vegetation consist of *Acacia haematoxylon* and *Grewia flava* specimens. Both these species are utilized by cattle during some months of the year but was not taken into consideration during the determination of the carrying capacity of the areas.

For the purpose of the carrying capacity evaluation, the mining right area was divided into two evaluation areas (A and B), as indicated on Figure 8.

1.1.5.3 Carrying capacity of Evaluation Area A

The typical vegetation in Zone A is shown in Figure 9. This area is fenced and grazing can therefore be regulated. The results of the survey are presented in Table 7.

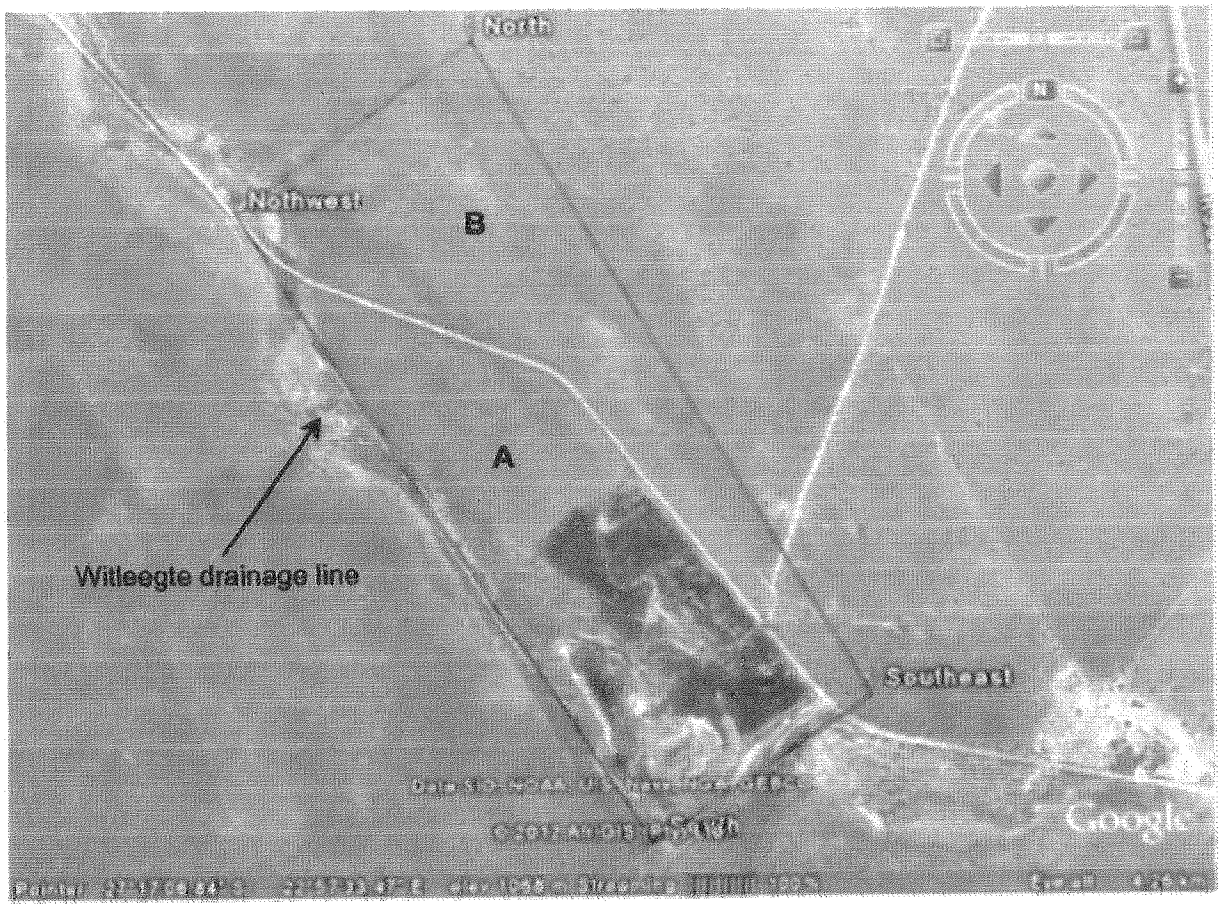


Figure 8 Carrying Capacity evaluation areas

Table 7 Data collected for Area A (SW side of road, Bull Camp)

No	Species	Palatability	Perennial (P) Annual (A)	Frequency		Basal Cover	
				Nearest Point	%	Hits	%
	Bare soil			279	69.8		
	Herbs			13	3.3		
1	Aristida meridionalis	Very low	P	12	3.0		
2	Stipagrostis uniplumis	Medium	P	1	0.3		
3	Pogonarthria squarrosa	Medium	A	2	0.5		
4	Melinis repens	High	A	6	1.5	1	0.25
5	Eragrostis lehmanniana	Medium	P	65	16.3	4	1.00
6	Schmidtia pappophoroides	High	P	8	2.0		
7	Aristida stipitata	Very low	P	13	3.3		
8	Aristida congesta subsp. congesta	Low	A	1	0.3		
	TOTAL: 8		**P = 5 (62.5%) A = 3 (37.5%)**	**400**	**100**	**5**	**1.24**
	Estimated Crown Cover		40%				

Important information from the data includes:

Bare ground frequency	69.75%
Perennial grasses frequency	24.75%
Annual grasses frequency	2.25%
% Perennial species found in survey	62.5%
% Annual species found in survey	37.5%
Basal cover	1.25%

Crown cover (estimate)	40%
High palatability	11.5% of grass cover
Medium palatability	55.4% of grass cover
Low palatability	1.6% of grass cover
Very low palatability	20.7% of grass cover
Herbs	10.7% of the herb layer

Although nearly 67% of herb layer is Medium and High palatable grasses, it must be kept in mind that nearly 70% of the frequency of occurrence is bare ground. The large tufts of unpalatable grasses are giving the impression of a good cover (Figure 9), while the opposite is demonstrated by the high bare ground result, low basal cover of 1.25% and crown cover of 40%. The Witleegte drainage line area was not taken into consideration in the survey because it is only a very small strip on the western border of Area A.

Based on the information presented above, as well as observations made during the survey, the points scored for the different criteria in Area A are as follows:

A - Botanical composition 7

B - Plant cover 7

C - Vitality 8

E - Insect and rodent damage 8

Veld condition rating for Area A is therefore **71.50.**

Carrying capacity (350mm rainfall area) for Area A is **14.5Ha/LSU.** This means that, over the 160ha of the proposed project 11 less cattle can be grazed. At present, approximately 53 ha of the project area is impacted by historical mining activities and is not currently used for cattle grazing by the landowner. The implementation of the proposed mining project will therefore affect grazing over an area of 107 ha, which is equivalent to grazing 7 less animals in the area.

1.1.5.4 Carrying capacity of Evaluation Area B

This area is also fenced and grazing is controlled.

Table 8 Data collected for Area B (NW side of road)

No	Species	Palatability	Perennial (P) Annual (A)	Frequency		Basal Cover	
				Nearest Point	%	Hits	%
	Bare soil			349	87.3		
	Herbs			11	2.8		
1	Aristida meridionalis	Very low	P	9	2.3	5	1.25
2	Eragrostis pallens	Very low	P	8	2.0		
3	Eragrostis lehmanniana	Medium	P	10	2.5	3	0.75
4	Schmidtia pappophoroides	High	P	8	2.0		
5	Aristida stipitata	Very low	P	5	1.3		
	TOTAL: 8		**P = 5 (100%) A = 0 (0%)**	**400**	**100**	**8**	**2.00**
	Estimated Crown Cover		40%				

Important information from the data includes:

Bare ground frequency	87.25%
Perennial grasses frequency	10.00%
Annual grasses frequency	<1.00%
% Perennial species found in survey	100.00%
% Annual species found in survey	0.00%
Basal cover	2.0%
Crown cover (estimate)	40%
High palatability	15.7% of grass cover
Medium palatability	19.6% of grass cover
Low palatability	<1.0% of grass cover
Very low palatability	43.1% of grass cover
Herbs	21.6% of the herb layer

A positive result of the investigation is that during the survey no annual species were recorded in Area B, indicating that the area is dominated by perennial species. The negative result is the fact that 43% of the vegetation is grass species with a very low palatability (Figure 10). Another negative result is the 87% bare ground frequency and an estimated crown cover of only 40%. Only 35% of the grass component is considered medium and high palatable material.

From the information presented above, as well as from observations made during the survey, the points scored for Area B are as follows:

A - Botanical composition 6.5

B - Plant cover 7

C - Vitality 8

E - Insect and rodent damage 8

Veld condition rating applying the formula is therefore **67.75.**

Carrying capacity (350mm rainfall area) is therefore **15.0Ha/LSU**

The species diversity in both areas evaluated is very low and only 8.5 species were on average recorded, although 15 grass species could be identified. It is important to note that only 44% of the herb layer includes species with medium to high palatability, while 32% is low to very low palatable species. The herb *Elephanthorrhiza elephantine* (Elephant's root) is the dominant herb, contributing to 16% of the herb layer.

It is furthermore noted that, during high rainfall seasons, the carrying capacity of the area will be higher, while the opposite will be true during low rainfall seasons.

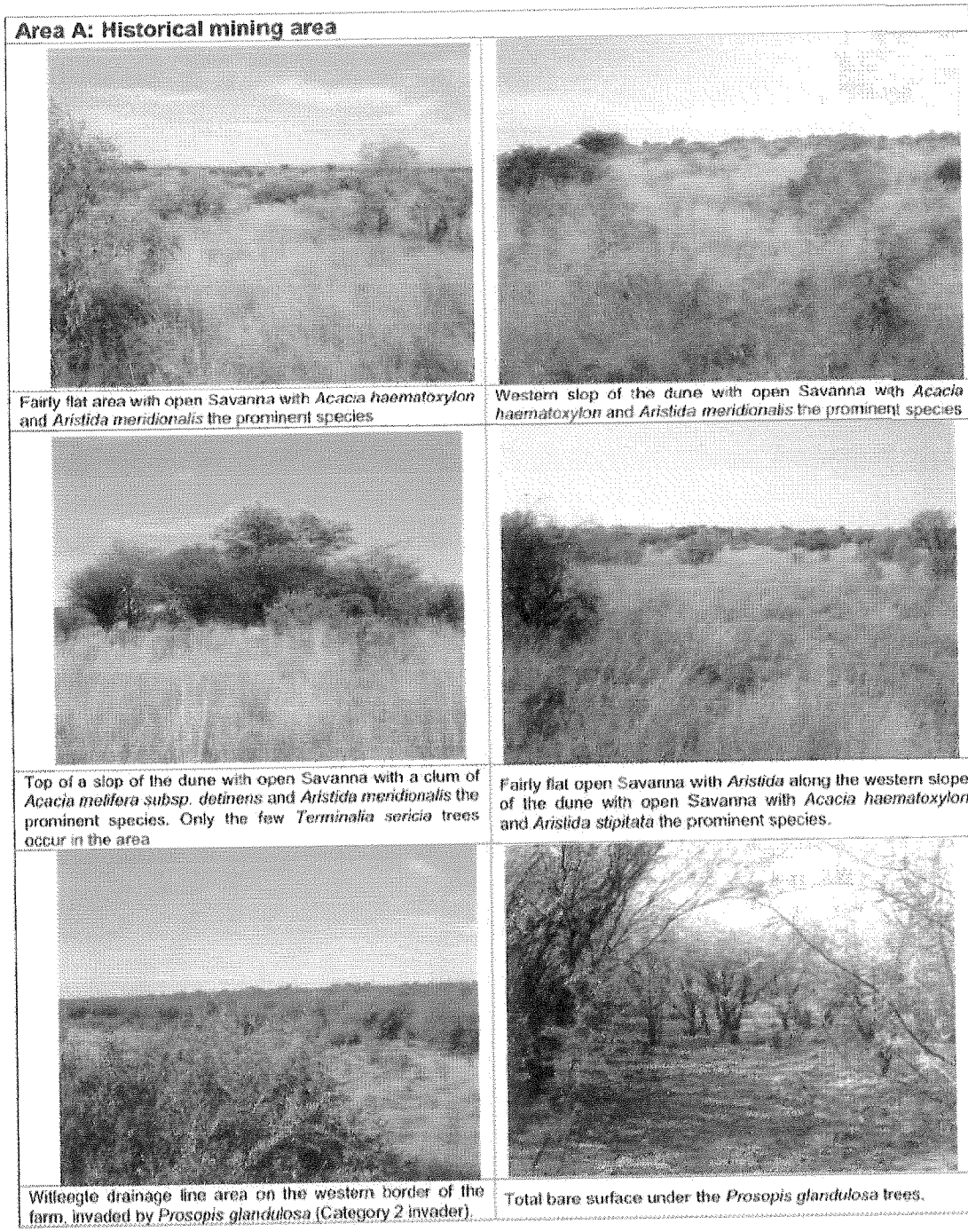


Figure 9 Carrying Capacity: Typical vegetation in Area A

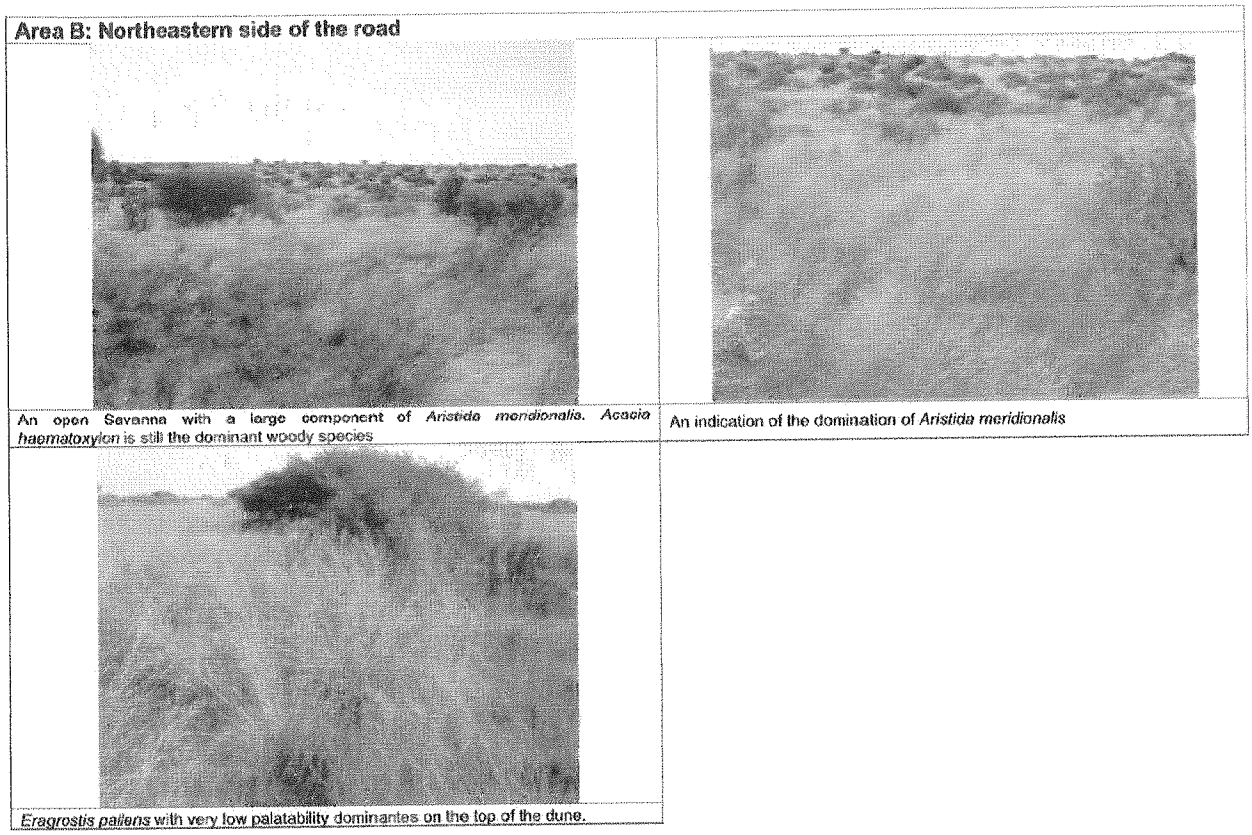


Figure 10 Carry Capacity: Typical vegetation in Area B

1.1.6 Biodiversity

South Africa's National Environmental Management Act (NEMA) (Act 107 of 1998) and National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004) requires the protection and effective management of the environment with specific emphasis on ecosystem and species diversity and specific systems such as wetlands.

A literature and desktop review was undertaken by EkoInfo (2012) based on scientific and popular publications, small- and large-scale Geographic Information System (GIS) datasets and a site visit undertaken in March 2012. The objective of the study was to assess the ecological sensitivity of the project area in the context of the regional and national setting. The full EkoInfo specialist study is contained in Appendix 3.

1.1.6.1 Vegetation

The project area is situated within the least threatened Kathu Bushveld regional vegetation unit, within the Savanna Biome, as indicated in Figure 11. This vegetation type is found on the plains from Kathu and Dibeng in the south, through Hotazel, to the Botswana border, at altitudes of 960 – 1300 mamsl. The vegetation is characterised by a medium-tall tree layer with *Acacia erioloba* and *Boscia albitrunca* in places, but consists mostly of open Savanna. The shrub layer generally consists of *A. mellifera, Diospyros lyciodes* and *Lycium hirsutum*. The grass layer is variable in cover.

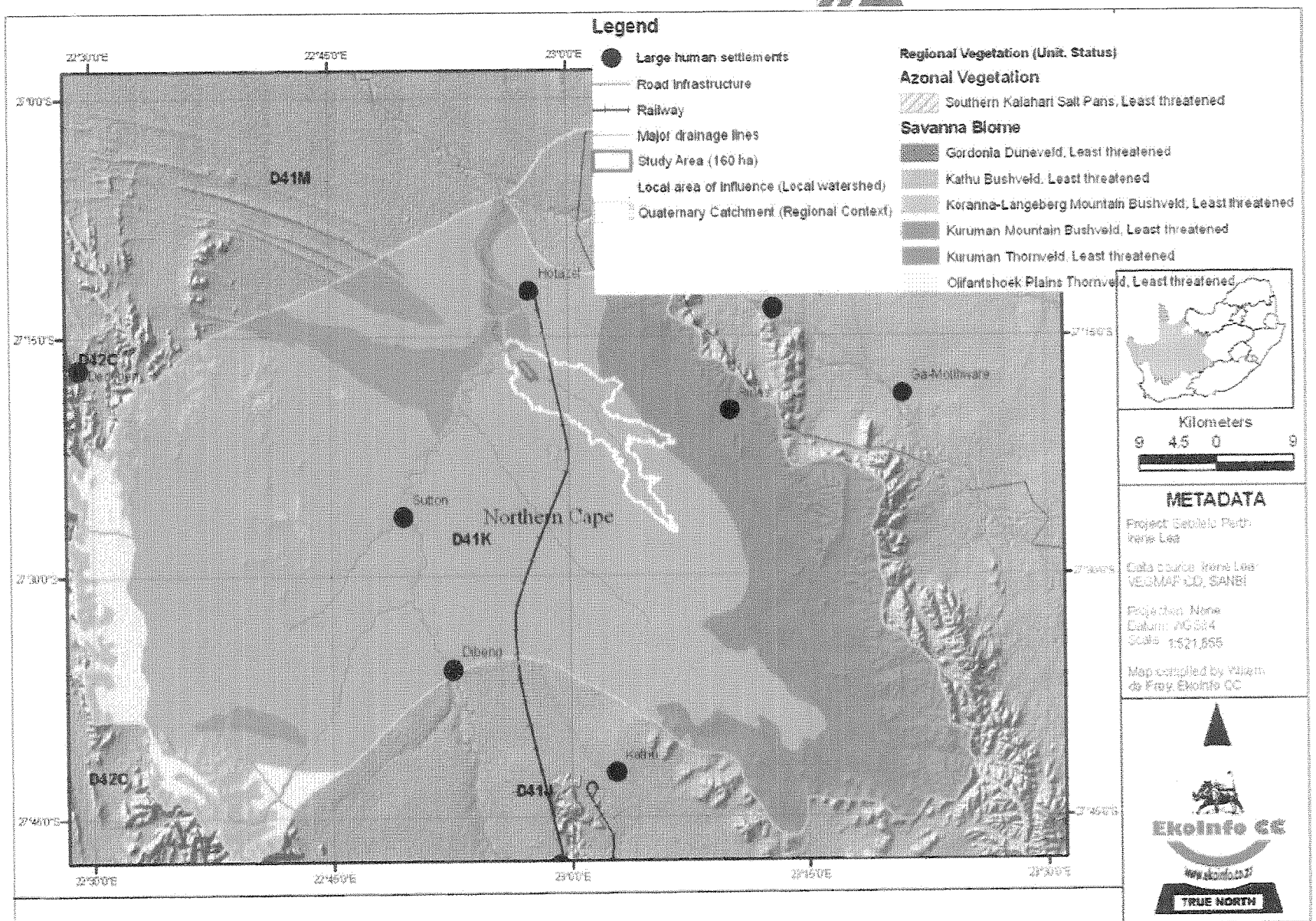


Figure 11 Regional vegetation units

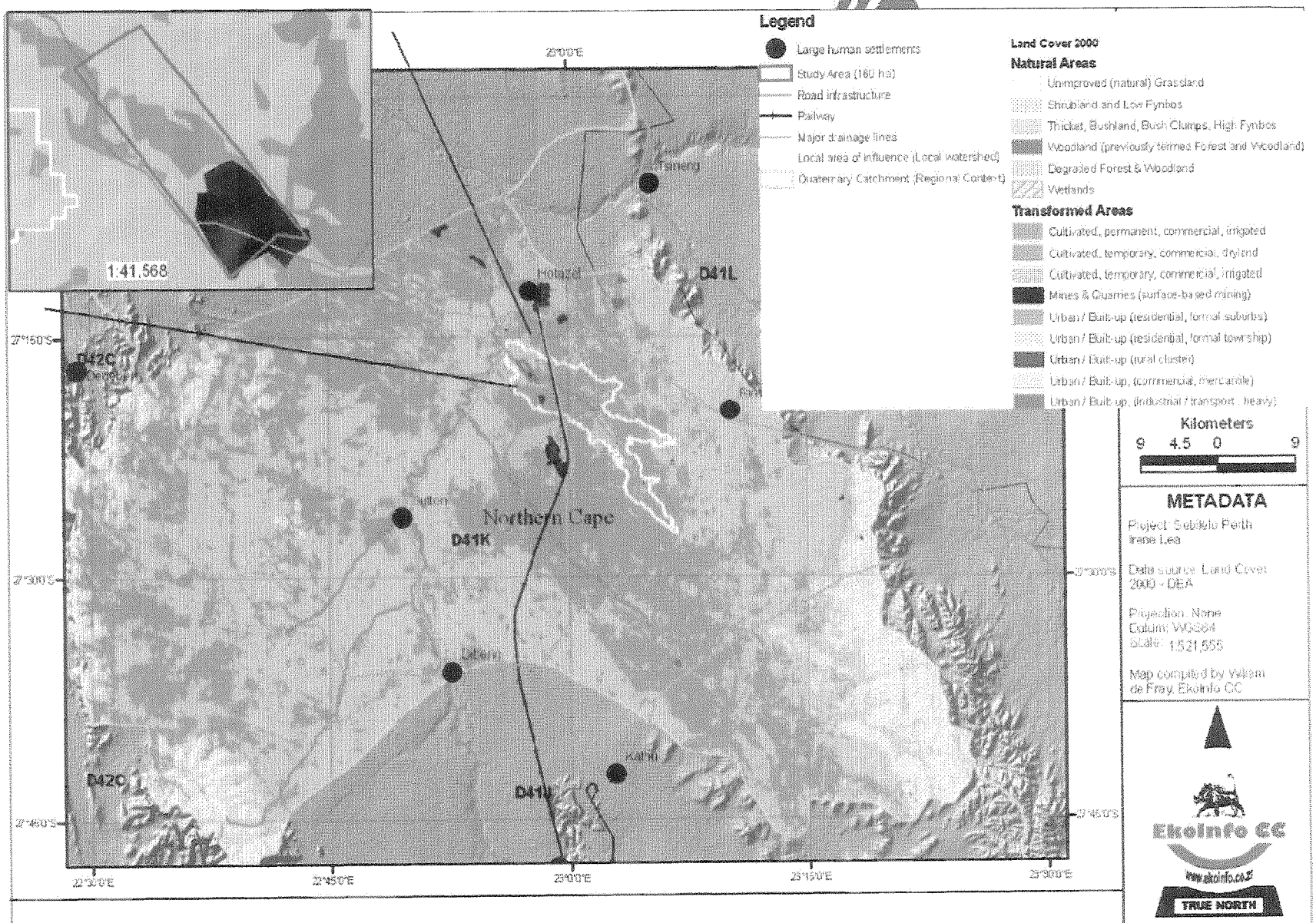


Figure 12 Associated land cover categories

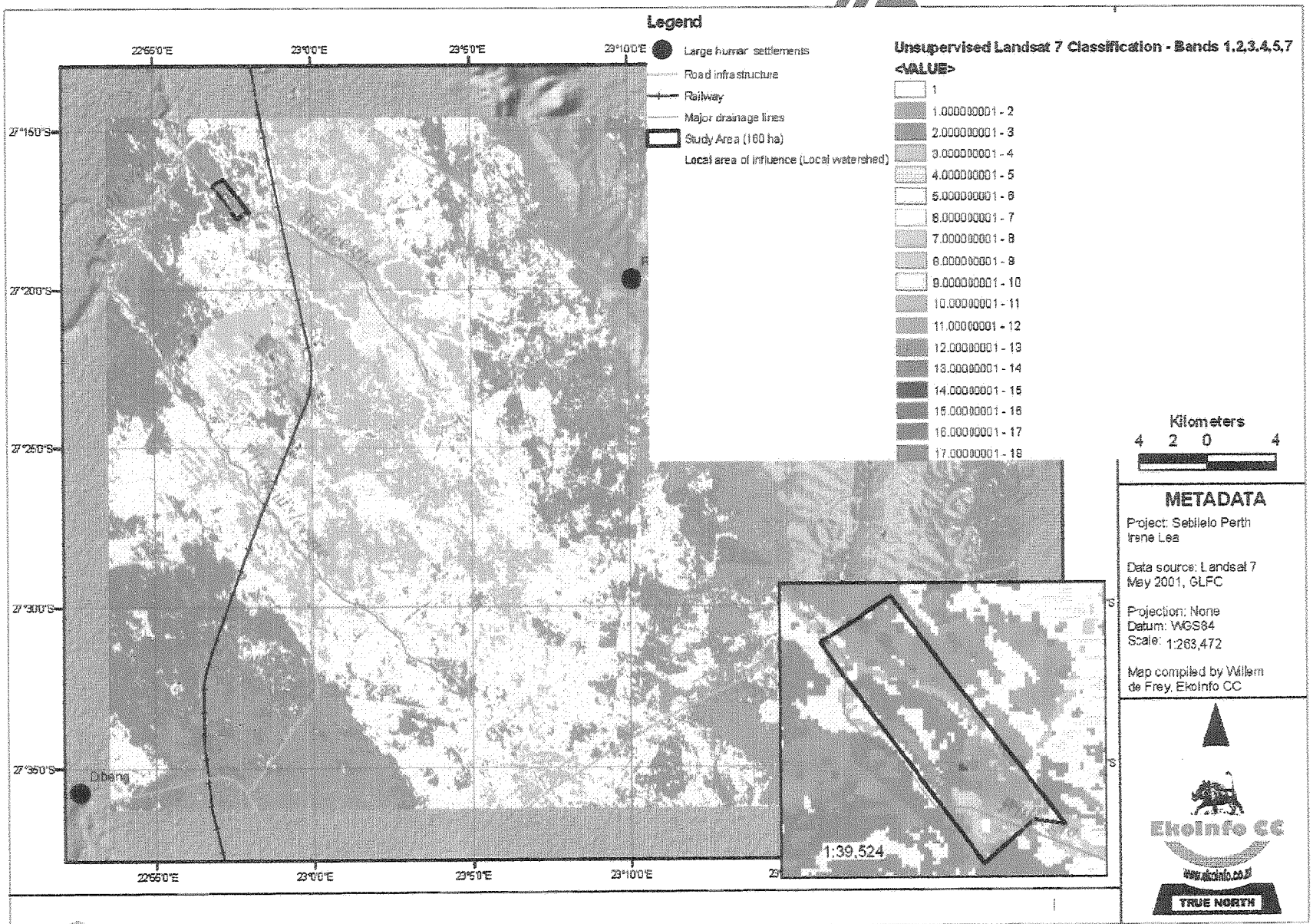


Figure 13 Satellite imagery showing vegetation variation

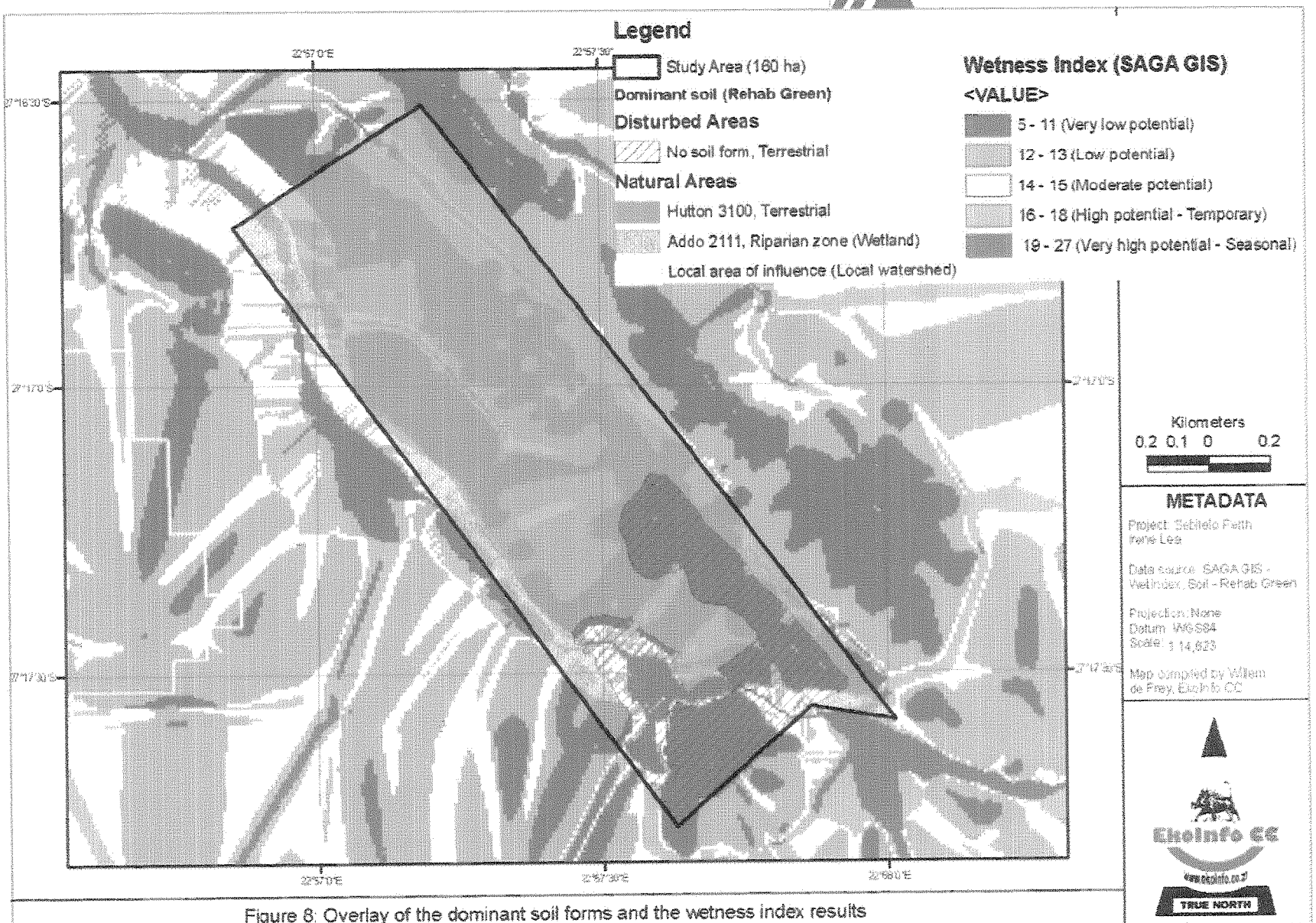


Figure 8: Overlay of the dominant soil forms and the wetness index results

Figure 14 Wetness Index Results (with soil overlay)

Umfaan (2012) identified the following grass, tree and shrub species within the project area.

Table 9 Grass species identified on site

Species	Common Name	
	English	Afrikaans
Aristida adscensiones	Annual tree-awn	Eenjarige steekgras
Aristida congesta subsp. Congesta	Tassel tree-awn	Katstertsteekgras
Aristida meridionalis	Giant tree-awn	Langbeensteekgras
Aristida stipitata	Long-awned Three-awn	Langnaaldsteekgras
Aristida argentea	Circle wool grass	Rondomgras
Cenchrus ciliaris	Blue Baffalo grass	Bloubuffelsgras
Enneapogon cenchroides	Nine-awned grass	Negenaaldgras
Eragrostis echinochloidea	Tick grass	Bosluisgras
Eragrostis lehmanniana	Lehman's love grass	Knietjiesgras
Eragrostis trichophora	Hairy love grass	Harige-pluimgras
Melinis repens	Natal red top	Fluweelgras
Panicum kalaharense	Kalahari Buffalo grass	Kalahari Buffelsgras
Pogonarthria squarrosa	Herringbone grass	Sekelgras
Schmidtia kalihariensis	Kalahari sour grass	Kalahari suurgras
Schmidtia pappophoroides	Sand quick	Sandkweek
Stipagrostis obtuse	Small Bushman grass	Kortbeenboesmangras
Stipagrostis uniplumis	Silky bushman grass	Blinkhaarboesmangras

Table 10 Tree and shrub species identified on site

Species	Common Name	
	English	Afrikaans
Acacia erioloba	Camel Thorn	Kameeldoring
Acacia haematoxylon	Grey Camel Thorn	Vaalkameeldoring
Acacia hebeclada	Candle Thorn	Trassiebos
Dispyros lyciodes	Blue Bush	Bloubos
Grewia flava	Raisin Bush	Rosyntjiebos
Melia azedarach	Seringa	Sering
Nicotiana glauca	Wild tobacco	Wilde tabak
Prosopis glandulosa	Honey Mesquite	Heuningprospopis
Rhus lancea	Karree	Karee
Schinus molle	Pepper Tree	Peperboom
Terminalia sericea	Silver Cluster Leaf	Sandgeelhout
Ziziphus mucronata	Buffalo Thorn	Blinkblaar-wag-'n-bietjie

1.1.6.1.1 Human influence: Vegetation

In terms of the available land cover information (Figure 12), it is evident that the quaternary catchment in which the project is situated (D41K) is in a pristine state in terms of transformation levels, with less than 1% of the land cover being associated with transformation (habitat loss and fragmentation). It is therefore anticipated that the development of the proposed Perth mine will contribute less than 1% to transformation in the quaternary catchment.

On a local landscape level[1], the level of transformation or habitat loss is low at 1%. The footprint of the mine will contribute 2% to habitat loss on a local scale. On the study area level (Table 11), 109 ha or 68% is natural with 52 ha or 32% already transformed through historical mining activities. None of the vegetation categories within the study area is degraded, therefore the remaining natural vegetation within the study area and the landscape within the regional context, as a whole represent a pristine area.

[1] An area of 1 km² or more consisting of various communities, natural or manmade, which reflects or influences ecosystem function and services on a local scale (Van Andel & Aronson 2006, Wiens, Moss, Turner & Mladenoff 2006, Turner, Gardner & O'Neill 2001, Lindenmayer & Fischer 2006, Barbour, Burk & Pitts 1980, Hilty, Lidicker Jr & Merenlender 2006).

Table 11 Level of human influence within the study area

Land Cover 2000 Categories	Surface Area (ha)	% Cover	Derived Ecological Status	
			Natural Areas	Transformed Areas
Thicket, Bushland, Bush Clumps, High Fynbos	68	42%	68	
Mines & Quarries (surface-based mining)	52	32%		52
Woodland (previously termed Forest and Woodland)	41	26%	41	
TOTAL	**161**	**100%**	**109**	**52**
			68%	**32%**

1.1.6.1.2 Ecosystem diversity: Vegetation

The literature review indicated that the site is located within a single regional vegetation unit or ecosystem on a national scale. At a local scale (farm level) the variation in altitude, slope, aspect and soil conditions typically result in local vegetation communities or ecosystems. Satellite imagery was used to highlight the local ecosystem diversity within the area and on site. From this information, 18 potential vegetation communities have been identified, as shown in Figure 13. Of the 18 vegetation clusters, 14 clusters are present in the Witleegte drainage line as shown. Satellite imagery further suggests that 7 of the clusters present in the drainage line are also present within the study area. It is not possible to determine the nature (species composition) of these vegetation communities or whether they contain species of concern (Red Data, protected, medicinal, alien invasive) from the satellite imagery. More details regarding this assessment are presented in the EkoInfo specialist study in Appendix 3.

Using the available Digital Elevation Model (DEM) from the NASA's Space Shuttle survey, it was possible to model the potential for water to accumulate in the landscape using a wetness index. The results of the wetness index, overlain with the dominant soil forms, are presented in Figure 14. The figure demonstrates that there is a good correlation between the wetness index and the soil forms, with the wetness index showing a slightly broader extent. In the absence of a detailed wetland assessment the precautionary principle should apply and infrastructure should be kept at least 100 m away.

1.1.6.1.3 Species of concern: Vegetation

According to the South African National Biodiversity Index (SANBI) database, a total of 530 species may be present (see Appendix 3), representing 84 families and 285 genera. The following six (6) families contain more than 50% of the species:

> Poaceae, Asteraceae, Fabaceae, Malvaceae, Cyperaceae, Scrophulariaceae.

The following 62 genera contain more than 50% of the species:

> Eragrostis, Euphorbia, Cyperus, Hermannia, Indigofera, Aristida, Helichrysum, Solanum, Acacia, Aptosimum, Crotalaria, Hibiscus, Limeum, Searsia, Asparagus, Cleome, Felicia, Stipagrostis, Abutilon, Barleria, Dicoma, Geigeria, Heliotropium, Lycium, Melolobium, Panicum, Rhynchosia, Salsola, Tephrosia, Wahlenbergia, Andropogon, Brachiaria, Chascanum, Cheilanthes, Commelina, Cucumis, Digitaria, Enneapogon, Gisekia, Jamesbrittenia, Kalanchoe, Melhania, Monechma, Moraea, Osteospermum, Oxalis, Oxygonum, Pentzia, Phyllanthus, Portulaca, Salvia, Sida, Sporobolus, Striga, Tragus, Tribulus, Triraphis, Anthephora, Arctotis, Asplenium, Babiana, Bergia.

The majority of the 530 species belong to one of the following major growth forms, either forbs or woody, with forbs being the most dominant growth form. More details regarding this assessment are presented in Appendix 3.